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This Issue

Annual Meeting AIHA
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A PRELIMINARY program of the Annual Meeting AIHA is being mailed to all members of the Association.

Hotel reservations should be made through the Housing Bureau, Buffalo Convention & Tourist Bureau, Inc., 602 Genesee Building, Buffalo, New York, and as early as possible, as the outstanding program being presented points to a large attendance.

THE importance of the exhaustive bibliographic compendium on respirators and respiration through them, compiled by LESLIE SILVERMAN, has led us to devote a large part of this issue to it. The material will be of permanent value to all interested in the many phases of the subject covered—particularly since the compiler has had such an extensive background of research in this field. . . . IF MERCURY is used in your laboratory, be sure to give careful attention to the findings of RENES and SEIFERT. Similar exposures may exist and the recommended control measures may be very much in order if slowly developing injury to the health of your laboratory workers is to be avoided . . . . THE congratulations of the Association are extended to WILLIAM P. YANT, D.SC., on being selected to receive the Pittsburgh Award of the American Chemical Society. . . . POWDER metallurgy is something which many of us have heard of but few of us have been intimately acquainted with. SHAW and KNOPP have outlined the processes and pointed to the exposures incident to these operations . . . . MEMBERS of the Association should refer to the biographical notes on the nominees for the next AIHA election, all amply qualified.

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A Bibliography on Protective Respiratory Devices and the Physiology of Respiration through Resistance and Masks

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On any research problem the investigator is always confronted with the problem of knowing what has been done previously. Faced with this situation on a recent war research project we found it desirable to assemble a bibliography of all of the available material on the physiology, operation and design of respiratory protective devices. Such information is obviously helpful to the investigator interested in designing a better gas mask or protective respiratory device. It is also of interest to those engaged in increasing the comfort and efficiency of such devices worn by men in industry. Many people recommend the use of respirators and masks for industrial purposes and yet are not aware of their influence on respiration and the individual's ability to perform muscular work under such conditions. Industrial hygienists will find this information is also of value with regard to the general problem of respiratory disability and physiological measurements during work. Several of the classical and important references on the physiology of muscular work have been included. The references cited in this bibliography include all of the domestic and foreign literature available from 1900 to July, 1945.

All of the reference sources listed below have been carefully examined for related material. We believe that everything extant on physiology of respiration through masks and respiratory resistance which has any bearing on protective respiratory devices has been included. Since we are only human, it is quite possible that some references may have been overlooked. The section on physiology of respiration is by no means complete. We have selected only those related references which are classical or provide fundamental information.

Material on dermatology and skin reactions to mask materials is not included. Patents on gas masks and respirators for protective purposes are complete, but purely clinical masks are not included. Patents on valves and component parts of masks are not complete, but those of recent development are included.

List of Journals

All journals cited are listed at the end of the Bibliography. The items are arranged in alphabetical order of their abbreviations

and followed in each case by their full titles. The form of abbreviations and the full titles have been copied from A Bibliography of Aviation Medicine published in 1942, which in turn used A World List of Scientific Periodicals published n the years, 1900-1933, 2nd Ed. For journals not cited in A Bibliography of Aviation Medicine, the World List was referred to directly. Starred references could not be found in either book and have been checked in various lists where they could be found and abbreviations made to conform to the style of the World List. The most recent place of publication has been given for each journal. Journals, the names of which have changed, are listed under both titles with different abbreviations. Proceedings are under journals with page numbers marked "P."

General Arrangement and Style

THE GENERAL arrangement and style is similar to that of A Bibliography of Aviation Medicine. The Table of Contents shows the groupings into which the articles are divided. Within these groups, the articles are in alphabetical order by author's name, with anonymous articles at the end. Names, titles and references are given as printed on the title page of the article except that only the author's initials are used. The form of author, title, place, publisher and date pages for books follows the style of A Bibliography of Aviation Medicine. Titles are given in their original language wherever possible and English translations are given in every case. These translations were taken from a Quarterly Cumulative Index Medicus, or were translated by the authors. Articles published in more than one journal have both references given.

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Physiological Abstracts.

Journal of Industrial Hygiene, Abstract Section.

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Carnegie Institute of Washington, D. C. Nutrition Laboratory, Boston, Mass. Reference files.

Harvard School of Public Health, Department of Industrial Hygiene, Boston, Mass. Reference files.

U. S. Patent Index.

Acknowledgements

THE AUTHOR wishes to express his appreciation to Mrs. Anne R. Yancey for her inestimable aid in compiling this bibliography. Appreciation is also expressed to Dr. T. M. Carpenter for his helpful criticism and aid in supplying reference material.

Physiological Measurements and Data on Respiration in Gas Masks and on Resistance to Breathing

Physiological Response to Wearing of Masks

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Physiological Response to Dead Space in Masks

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Related Physiological Material to Breathing in Gas Masks

Ventilation Measurements and Apparatus for Measuring Air Flow

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Physical and Chemical Data on Gas Masks and Respirators

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Patents on Gas Masks, Respirators, and Valves

Gas Masks and Respirators

Respiratory mask or helmet. C. H. Wood. U. S. 667,481, Feb. 5, 1901.
Respiratory apparatus for firemen and others. C. E. Chapin and A. A. Sherman. U. S. 764,709, July 12, 1904.
Mask. R. K. Catt. U. S. 865,996, Sept. 17, 1907.
Respiration mask. G. F. Goodnow. U. S. 902,961, Nov. 3, 1908.
Respiratory apparatus. E. E. Zerkle. U. S. 909,979, Jan. 19, 1909.
Respiratory apparatus. J. Tissot. U. S. 932,515, Aug. 31, 1909.
Breathing mask. E. Kuhn. U. S. 938,247, Oct. 26, 1909.
Respiration apparatus for use in coal mines and other places. W. E. Garforth. U. S. 953,462, March 29, 1910.
Respirator smoke protector. M. Panian. U. S. 958,427, May 17, 1910.
Respiratory apparatus for firemen or others. C. E. Chapin. U. S. 986,907, March 14, 1911.
Face mask. H. C. Graybill and A. C. Ergler. U. S. 1,077,272, Nov. 4, 1913.
Fireman's mask. A. F. Macrini. U. S. 1,079,251, Nov. 18, 1913.
Mask. C. Scheer. U. S. 1,096,761, May 12, 1914.
Respiratory mask. C. A. Furtaw. U. S. 1,127,612, Feb. 9, 1915.
Mask, helmet, or the like for use with respiratory apparatus. A. B. Dräger. U. S. 1,150,508, Aug. 17, 1915.
Air face mask. J. M. Ganzer. U. S. 1,185,392, May 30, 1916.
Gas mask and respirator. N. Schwartz. U. S. 1,313,745, Aug. 19, 1919.
Gas mask. C. W. Kohler and F. H. Martin (to B. F. Goodrich Co.). U. S. 1,315,515, Sept. 9, 1919.
Respirator. H. S. Raper and B. Lambert. Brit. 255,165, Sept. 25, 1919.
Gas mask. N. Schwartz. U. S. 1,320,935, Nov. 4, 1919.
Open face gas mask. G. A. Mickelson. U. S. 1,344,349, June 22, 1920.
Gas mask. E. W. Miller. U. S. 1,348,819, Aug. 3, 1920.
Gas mask. J. M. McGargill. U. S. 1,362,766, Dec. 21, 1920.
Gas mask. R. Monro (to Waldemar Kops). U. S. 1,395,759, 1,395,760 and 1,395,761, Nov. 1, 1921.
Respirator mask. J. A. Knoblock (to American La France Fire Engine Co.). U. S. 1,410,927 and 1,410,928, March 28, 1922.
Gas mask. R. P. Mase (to Mine Safety Appliances Co.). U. S. 1,474,205, Nov. 13, 1923.
Rubber gas mask. Naamlooze Vennootschap Vereenigde Nederlandsche Rubberfabrieken. Brit. 275,940, Aug. 14, 1926.
Respirator mask. H. S. Olgard. U. S. 1,610,106, Dec. 7, 1926.
Respirator mask. H. S. Olgard. U. S. 1,630,209, May 24, 1927.
Closed-circuit respirators. Inhabad-Ges. Brit. 304,248, Jan. 17, 1928.
Gas mask. J. A. Sadd. Brit. 324,909, Oct. 30, 1928.
Respirator supplied with auxiliary oxygen. E. Dräger (to O. H. Dräger). Brit. 332,502, Dec. 15, 1928.
Protective mask for use in noxious gases. A. B. Dräger. U. S. 1,710,813, April 30, 1929.
Respiratory apparatus. A. Muntwyler. Brit. 365,762, Jan. 20, 1930.
Gas mask. R. Monro. U. S. 1,762,695, June 10, 1930.
Closed-circuit respirators employing oxygen-generating chemicals. Deutsche Gasglühlicht-Auer-G. m. b. H. Brit. 372,638, Aug. 7, 1930.
Inhaling device. J. F. Class. U. S. 1,775,986, Sept. 16, 1930.
Respiratory helmet. A. Belloni. Brit. 378,896, May 16, 1931.
Respirator. R. H. Davis. Brit. 371,278, Oct. 1, 1931.
Respiratory apparatus. R. H. Davis. Brit. 377,031, Oct. 19, 1931. (Addn. to 371,278)
Mask. F. J. McMichael. U. S. 1,828,427, Oct. 20, 1931.
Gas mask. F. Schleich and Clora-Fabrikate Cloetta & Co. m. b. H. Brit. 384,886, April 11, 1932.
Mask. F. R. M. Bulmer. U. S. 1,878,464, Sept. 20, 1932.
Closed-circuit respiratory appliance. A. M. H. L. Christensen. Brit. 389,358, March 16, 1933.
Respirator. R. H. Davis. Brit. 390,855, April 12, 1933.
Respiratory apparatus of the closed-circuit, oxylith regenerator type. G. E. Lemoine. Brit. 393,874, June 15, 1933.
Protective mask. H. A. Fee. U. S. 1,917,961, July 11, 1933.
Gas mask. R. Weichert. Brit. 396,904, Aug. 17, 1933.
Gas-proof mask. M. Baudou. Fr. 751,103, Aug. 28, 1933.
Respirator. J. de Saint-Rapt and G. Decombe. Brit. 399,390, Oct. 5, 1933.
Mask for the absorption of poisonous gases. M. F. Serjo. U. S. 1,948,945, Feb. 27, 1934.
Gas mask. S. A. H. Enghoff (to Kungl. Arméförvaltningens Artilleridepartement). Swed. 79,769 and 79,770, March 6, 1934.
Apparatus for recording the amount of oxygen absorbed and carbon dioxide eliminated during respiration. G. Mansfeld. Fr. 761,644, March 23, 1934.
Mask. R. Malcolm. U. S. 1,960,544, May 29, 1934.
Portable respiratory apparatus of the closed-circuit type. J. M. G. G. de Boudemange. Brit. 411,214, June 7, 1934.
Respiratory mask. J. E. Leduc. Brit. 411,311, June 7, 1934.
Gas mask. M. Müszaki and R. T. Vegyipari. Hung. 110,433, Aug. 1, 1934.
Gas mask. F. C. Montouri. U. S. 1,975,797, Oct. 9, 1934.
Gas mask. G. Dolne-Dehan. Brit. 421,038, Dec. 12, 1934.
Gas mask. A. Senft. Brit. 425,152, March 7, 1935.
Gas mask. A. Senft. Brit. 425,744, March 20, 1935. (Addn. to 425,152)
Gas mask. Società italiana Pirelli. Brit. 428,259, May 9, 1935.
Gas mask. A. Senft. Brit. 428,338, May 10, 1935.
Gas mask. J. Stapelfeldt and H. Stoltzenberg. Brit. 429,824, June 6, 1935.
Breathing mask. L. H. Booharin (one-third to W. H. Lea and one-third to B. Werner). U. S. 2,005,072, June 18, 1935.
Air mask. H. A. Brand. U. S. 2,007,440, July 9, 1935.
Gas mask. R. P. Howes. Brit. 431,671, July 12, 1935.
Gas mask. H. Stoltzenberg (trading as Chemische Fabrik Hugo Stoltzenberg). Brit. 433,848, Aug. 21, 1935.
Respirator. Bartels & Rieger Hermat G. m. b. H. Brit. 438,863, Nov. 25, 1935.
Gas mask. A. Leigh-Smith and H. O. W. Richardson. Brit. 438,980, Nov. 27, 1935.
Gas masks. Societa italiana Pirelli. Brit. 440,943, Jan. 8, 1936.
Gas masks. Societa italiana Pirelli. Fr. 793,297, Jan. 21, 1936. (see Brit. 440,943)
Gas mask. C. J. Gordon. Brit. 442,224, Feb. 3, 1936.
Gas mask. W. Dawson. Brit. 444,962, March 25, 1936.

Anti-gas appliances. Stamm & Co. Swiss 183,562, July 1, 1936 (Cl. 177a).
Gas mask. R. P. Howes. Brit. 451,912, Aug. 13, 1936.
Gas mask. E. H. Bullard (to E. D. Bullard Co.). U. S. 2,051,023, Aug. 18, 1936.
Gas mask. J. A. Sadd. Brit. 455,099, Oct. 12, 1936.
Face mask. F. G. Manson. U. S. 2,062,325, Dec. 1, 1936.
Gas mask. C. F. Lumb. Brit. 458,403, Dec. 14, 1936.
Gas mask equipment. T. A. O'Leary. U. S. 2,077,054, April 13, 1937.
Gas mask. V. Pinelli. Brit. 464,458, April 19, 1937.
Gas mask. E. F. Bourcey and R. I. Bourcey. Brit. 472,536, Sept. 24, 1937.
Gas mask. J. Nicolaidi. Brit. 472,897, Sept. 27, 1937.
Gas mask. F. F. Hofstötter. Brit. 473,612, Oct. 15, 1937.
Gas mask. Fatra Akciova Spolecnost. Brit. 475,832, Nov. 26, 1937.
Respiratory mask. Martindale Electric Co., Ltd. and H. L. K. Johnson. Brit. 479,807, Feb. 11, 1938.
Facial mask. W. G. Thurber. U. S. 2,109,018, Feb. 22, 1938.
Gas mask. G. Ingram. Brit. 487,753, June 24, 1938.
Carrier, MIV, gas mask. U. S. Army Specification 97-53-17, July 22, 1938.
Gas mask. O. H. Dräger. Brit. 491,290, Aug. 30, 1938.
Gas mask. Società italiana Pirelli. Brit. 492,640, Sept. 23, 1938.
Gas mask. T. A. O'Leary (to Acme Protection Equipment Co.) U. S. 2,132,433, Oct. 11, 1938.
Gas mask. V. Horak. U. S. 2,156,852, May 2, 1939.
Fully molded gas mask facepiece. S. H. Katz and D. O. Burger. U. S. 2,164,330, July 4, 1939.
Improving gas masks. L. Houzelle. Fr. 843,953, July 13, 1939.
Gas mask. Chema Akt.-Ges. Austrian 156,691, Aug. 10, 1939 (Cl. 61).
Gas mask. A. Hoff and Société d'exploitation des établissement Lick et des Brevets Paramount. Fr. 845,815, Sept. 4, 1939.
Gas mask. L. de la Savoureuse and J. Lauffer. Fr. 845,983, Sept. 6, 1939.
Gas mask. Chema Akt.-Ges. Austrian 156,877, Sept. 11, 1939 (Cl. 61).
Gas mask. A. Hoff and Société d'exploitation des établissement Lick et des Brevets Paramount. Fr. 846,571, Sept. 20, 1939.
Gas mask. E. J. Lejeune. Fr. 846,648, Sept. 21, 1939.
Gas mask. E. J. A. Lejeune and D. Dreiss. Fr. 847,052, Oct. 3, 1939.
High altitude respirator. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 682,850, Oct. 5, 1939 (Cl. 61a. 29.04).
Improving gas mask equipment. Société Bronzaria. Fr. 847,735, Oct. 16, 1939.
Gas mask. F. Chassaing. Fr. 848,268, Oct. 26, 1939.
Gas mask. J. B. Delmas. Fr. 848,339, Oct. 26, 1939.
Gas mask. Société belge de l'azote et des produits chimiques du Marly. Fr. 848,525 and 848,526, Oct. 31, 1939.
Improving gas masks. L. Houzelle. Fr. 850,117, Dec. 13, 1939. (Addn. to Fr. 843,953)
Gas mask. O. Guttmann and H. Héribert. Fr. 851,972, Jan. 19, 1940.
Gas mask. General Tire and Rubber Co. Fr. 852,213, Jan. 26, 1940.
Gas mask. L. Frischknecht and F. Frischknecht. Fr. 852,260, Jan. 27, 1940.
Gas mask. R. Blanchet and M. Juteau. Fr. 852,999, March 7, 1940.
Gas mask for carbon monoxide. Chemische Fabrik Dr. Hugo Stolzenberg. Ger. 692,545, May 23, 1940 (Cl. 61a. 29.30).
Gas mask. Auergesellschaft Akt.-Ges. Ger. 693,265, June 13, 1940 (Cl. 61a. 29.30).
Gas mask. Deutsches Reich, represented by the Oberkommando de Heeres. Ger. 694,357, July 4, 1940 (Cl. 39a. 10.11).
Gas mask. Società italiana Pirelli. Swiss 210,028, Aug. 16, 1940 (Cl. 117a).
Gas mask. O. M. Geyer. Ger. 698,042, Oct. 3, 1940 (Cl. 61a. 29.10).
Respiratory mask. E. Smolczyk (to Auergesellschaft Akt.-Ges.). Ger. 698,043, Oct. 3, 1940 (Cl. 61a. 29.30).
Gas mask. J. Seidl (to Auergesellschaft Akt.-Ges.). Ger. 699,283, Oct. 31, 1940 (Cl. 61a. 29.10).
Respirator. H. B. Lewis. U. S. 2,220,374, Nov. 5, 1940.
Gas mask. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 701,922, Dec. 24, 1940 (Cl. 61a. 29.13).
Gas mask. J. Seidl and G. Voigt (to Auergesellschaft Akt.-Ges.). Ger. 702,314 and 702,315, Jan. 9, 1941 (Cl. 61a. 29.10 and 29.13).
Gas mask. R. Römer. Swiss 211,736, Jan. 16, 1941 (Cl. 117a).
Respirator. H. Reeck (to Auergesellschaft Akt.-Ges.). Ger. 703,478, Feb. 6, 1941 (Cl. 61a. 29.30).
Gas mask. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 703,931, Feb. 13, 1941 (Cl. 61a. 29.10).
Respirator. A. Hloch. Ger. 703,933, Feb. 13, 1941 (Cl. 61a. 29.30).
Oxygen inhalator. Auergesellschaft Akt.-Ges. Ger. 704,049, Feb. 20, 1941 (Cl. 61a. 29.01).
Gas mask. P. Kierdorff. Ger. 705,842, April 3, 1941 (Cl. 61a. 29.10).
Respirator mask. C. W. Leguillon (to B. F. Goodrich Co.). U. S. 2,238,492, April 15, 1941.
Respirator. N. K. Benos. U. S. 2,238,964, April 22, 1941.
Transparent gas mask. Chemische Fabrik Hugo Stoltzenberg. Ger. 706,440, April 24, 1941 (Cl. 61a. 29.10).
Gas mask respirator. C. W. Sirch. U. S. 2,253,538, Aug. 26, 1941.
Breathing apparatus for protection against poisonous gases. E. E. Menissier and P. J. H. Doussot. Brit. 539,260, Sept. 3, 1941.
Combined inhalation apparatus and gas mask. H. Lehmann. Brit. 540,488, Oct. 20, 1941.
Oxygen respirator. Auergesellschaft Akt.-Ges. Ger. 715,002, Nov. 20, 1941 (Cl. 61a. 29.05).
Respirator. W. H. Lehmberg (to American Optical Co.). U. S. 2,269,461, Jan. 13, 1942.
Respiratory apparatus. W. A. Wildhack. U. S. 2,269,500, Jan. 13, 1942.
Respirators. R. Kirgan, J. A. Sadd and C. G. Trotman. Brit. 543,673, March 9, 1942.
Gas masks, goggles and the like. B. Andersen (to Celanese Corp. of America). U. S. 2,280,055, April 21, 1942.
Gas mask. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 722,387, May 21, 1942 (Cl. 30i. 1).
Gas mask and associated filters. S. Hermann. U. S. 2,284,053 and 2,284,054, May 26, 1942.
Respirator and method of making the same. W. H. Lehmberg (to American Optical Co.). U. S. 2,290,885, July 28, 1942.
Gas mask. C. Bartels (to Bartels & Rieger). Ger. 727,907, Oct. 15, 1942 (Cl. 61a. 29.10).
Respirator. K. Connell (to Air Reduction Co., Inc.). U. S. 2,300,273, Oct. 27, 1942.
Gas mask. R. Vorbau (to Auergesellschaft Akt.-Ges.). Ger 728,600, Oct. 29, 1942 (Cl. 61a. 29.10).
Gas mask made from a thin, gas-tight material. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 728,601, Oct. 29, 1942 (Cl. 61a. 29.10).
Gas mask from pliable material. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 728,648, Oct. 29, 1942 (Cl. 61a. 29.10).
Respiratory device. H. M. Dodge and H. T. Kraft (to General Tire and Rubber Co.) U. S. 2,300,912, Nov. 3, 1942.
Mask for protecting infants against chemical warfare. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 728,944, Nov. 5, 1942 (Cl. 61a. 29.09).
Gas mask. Auergesellschaft Akt.-Ges. Ger. 728,954 and 728,955, Nov. 5, 1942 (Cl. 61a. 29.30).
Respirator which can be used as an air filter or as an oxygen inhalator. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 729,088, Nov. 12, 1942 (Cl. 61a. 29.01).
Gas mask with an inlet for liquid food. E. Schmidt (to Auergesellschaft Akt.-Ges.). Ger. 730,096, Dec. 3, 1942 (Cl. 61a. 29.13).
High-altitude mask. W. Meuschel (to Nökel Werke G. m. b. H.). Ger. 730,551, Dec. 17, 1942 (Cl. 61a. 29.13).
Gas mask. P. Günther. Ger. 730,703, Dec. 17, 1942 (Cl. 61a. 29.10).
Gas mask. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 730,824, Dec. 24, 1942 (Cl. 61a. 29.13).
Oxygen mask controlled by the lungs. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 730,982, Dec. 24, 1942 (Cl. 61a. 29.01).
Gas mask made of rubber or similar material. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 734,983, April 1, 1943 (Cl. 61a. 29.13).
Lung-operated, high-altitude oxygen mask. Auergesellschaft Akt.-Ges. Ger. 735,125, April 1, 1943 (Cl. 61a. 29.05).
High-altitude oxygen mask. I. G. Farbenind. Akt.-Ges. Ger. 735,186, April 8, 1943 (Cl. 61a. 29.04).
Mask. J. A. Heidbrink (to Air Reduction Co., Inc.). U. S. 2,317,608, April 27, 1943.
Gas mask. J. Seidl and E. Lötzsch (to Auergesellschaft Akt.-Ges.). Ger. 738,136, July 1, 1943 (Cl. 61a. 29.10).
Gas mask. S. Daly. U. S. 2,337,232, Dec. 21, 1943.

Valves

Respiratory valve. R. Munro. U. S. 1,853,373, April 12, 1932.
Nonreturn valve for breathing appliances. H. Stelzner (to Firm Drägerwerk Heinr. u. Bernh. Dräger). U. S. 1,867,478, July 12, 1932.
Check valve for respirators. H. F. Shindel (to Willson Products Inc.). U. S. 2,011,088, Aug. 13, 1935.
Exhalation valve. E. H. Bullard (to E. D. Bullard Co.). U. S. 2,038,267, April 21, 1936.
Expiration valve for respiratory apparatus in gas masks. G. Perron and A. Hoff. Fr. 846,811, Sept. 26, 1939 (Gr. 19—Cl. 4).
Exhalation valve. W. A. Whipple (to Robert Malcolm). U. S. 2,174,503, Sept. 26, 1939.
A gas-mask valve. Chema Aktiengesellschaft. Austrian 157,175, Oct. 10, 1939 (Cl. 61).
Sniffing valve on gas mask for gas-spotters. Auergesellschaft Akt.-Ges. Ger. 695,491, July 25, 1940 (Cl. 61a. 29.13).

Exhale valve for gas masks. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 695,492, July 25, 1940 (Cl. 61a. 29.13).
Inhale valve for gas mask. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 695,493, July 25, 1940 (Cl. 61a. 29.13).
Device for locking of the exhale valve on gas masks. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 699,063, Oct. 24, 1940 (Cl. 61a. 29.13).
Exhalation valve for gas masks. P. E. Young (to Acushnet Process Co.). U. S. 2,225,395, Dec. 17, 1940.
Exhale valve for gas masks. Auergesellschaft Akt.-Ges. Ger. 705,553, March 27, 1941 (Cl. 61a. 29.13).
Breathing apparatus supply valve. D. A. Green (to Mine Safety Appliances Co.). U. S. 2,288,565, June 30, 1942.
Outlet valve for gas masks. M. E. Barker. U. S. 2,291,603, Aug. 4, 1942.
Valve. W. P. Yant and J. F. Dauster (to Mine Safety Appliances Co.). U. S. 2,292,003, Aug. 4, 1942.
Exhale valve for gas masks. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 730,002, Dec. 3, 1942 (Cl. 61a. 29.13).
Gas-mask valve. G. Voigt (to Auergesellschaft Akt.-Ges.). Ger. 730,320, Dec. 10, 1942 (Cl. 61a. 29.13).
Valve for respirators. B. Bonatz and H. Reeck (to Auergesellschaft Akt.-Ges.). Ger. 738,795, July 29, 1943 (Cl. 61a. 29.13).

Miscellaneous

"Oxygen regulator" adapted for use by aviators. W. Gaertner (to Gaertner Scientific Corp.). U. S. 1,957,951, May 8, 1934.
Apparatus for determining the flow-resistance of gas-mask canisters or other respiratory appliance elements. J. T. Ryan (to Mine Safety Appliances Co.). Brit. 475,440, Nov. 19, 1937.
Determination of dead-space in gas masks and gas filters. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 705,725, March 27, 1941 (Cl. 61a. 29.40).
Gas-mask window. Langheck & Co. Ger. 714,632, Nov. 13, 1941 (Cl. 61b. 1.01).
Respirator eyepieces and the like. W. H. Moss (to Celanese Corp. of America). U. S. 2,280,097, April 21, 1942.
Gas mask carrier. C. M. Seidenknopf. Brit. 544,662, April 22, 1942.
Oxygen inhalator. O. Weber (to Auergesellschaft Akt.-Ges.). Ger. 728,599, Oct. 29, 1942 (Cl. 61a. 29.05).
Oxygen inhalator controlled by the lungs. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 729,087, Nov. 12, 1942 (Cl. 61a. 29.01).
Apparatus for testing oxygen masks. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 729,089, Nov. 12, 1942 (Cl. 61a. 29.40).
Instrument for testing the water-absorption capacity of gas-mask windows. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 729,090, Nov. 12, 1942 (Cl. 61a. 29.40).
Lung-operated oxygen tank. K. Balla (to Auergesellschaft Akt.-Ges.). Ger. 729,926, Dec. 3, 1942 (Cl. 30k. 13.01).
Apparatus for testing gas-mask valves. Drägerwerk Heinr. u. Bernh. Dräger. Ger. 730,322, Dec. 10, 1942 (Cl. 61a. 29.40).

Key to Abbreviations of Journals Cited in Bibliography

Style is that of *A World List of Scientific Periodicals*
*Indicates abbreviations not included in *A World List of Scientific Periodicals* (published 1900–1933, 2nd ed., London, 1934) nor in *A Bibliography of Aviation Medicine*.
• Indicates abbreviations included in *A Bibliography of Aviation Medicine* but not included in *A World List of Scientific Periodicals*.

1. Abstr. Lit. industr. Hyg. Abstract of the Literature of Industrial Hygiene (supplementary to the Journal of Industrial Hygiene), Cambridge, Mass.
2. Acta aerophysiol.• Acta aerophysiologica. Hamburg.
3. Acta Biol. exp., Varsovie. Acta biologiae experimentalis. Edité par l'Institut Nencki. Varsovie.
4. Acta brev. neerl. Physiol. Acta brevia Neerlandica de Physiologia, Pharmacologia, Microbiologia, e.a. Amsterdam.
5. Acta med. scand. Acta medica Scandinavica. Stockholm.
6. Acta Sch. med. Univ. Kioto. Acta Scholae Medicinalis Universitatis Imperialis in Kioto. Kioto.
7. Acta Univ. dorpat. (tartu.). Acta et Commentationes Universitatis Dorpatensis (Tartuensis). Dorpat.
8. Amer. J. med. Sci. American Journal of the Medical Sciences. Philadelphia.
9. Amer. J. Nurs. American Journal of Nursing. New York.
10. Amer. J. phys. Anthrop. American Journal of Physical Anthropology. Philadelphia.
11. Amer. J. Physiol. American Journal of Physiology. Baltimore.
12. Anesthesiol.• Anesthesiology. Journal of the American Society of Anesthetists, Inc. New York.
13. Angew. Chem. Angewandte Chemie. Berlin.
14. Ann. Méd. Annales de médecine. Paris.
15. Ann. Méd. phys. Annales de médecine physique (et de physiologie). Anvers. (See No. 18)
16. Ann. Min., Paris. Annales des mines. Paris.
17. Ann. Physiol. Physicochim. biol. Annales de physiologie et de physicochimie biologique. Paris.
18. Ann. Soc. Méd. phys. Anvers. Annales de la Société de médecine physique d'Anvers. Anvers. (see No. 15)
19. Apothekerztg, Berl. Apothekerzeitung. Berlin.
20. Arbeiterschutz.* Arbeiterschutz. Berlin.
21. Arbeitsphysiologie. Arbeitsphysiologie. Berlin.
22. Arch. Anat., Physiol. u. wissen. Med.* Archiv für Anatomie, physiologie und wissenschaftliche Medicin. Berlin; Leipzig. (Superseded by No. 23)
23. Arch. Anat. Physiol., Lpz. Archiv für Anatomie und Physiologie. Leipzig.
24. Arch. belges Serv. Santé Armée.• Archives belges du service de santé de l'armée. Bruxelles.
25. Arch. exp. Path. Pharmak. Naunyn-Schmiedebergs Archiv für experimentelle Pathologie und Pharmakologie. Berlin.
26. Arch. Fisiol. Archivio di fisiologia. Firenze.
27. Arch. Gewerbepath. Gewerbehyg. Archiv für Gewerbepathologie und Gewerbehygiene. Berlin.
28. Arch. Hyg., Berl. Archiv für Hygiene (und Bakteriologie). (Berlin.) München.
29. Arch. int. Physiol. Archives internationales de physiologie. Liége.
30. Arch. intern. Med. Archives of Internal Medicine. Chicago.
31. Arch. Mal. Appar. dig. Archives de maladies de l'appareil digestif et de la nutrition. Paris.
32. Arch. méd. belges. Archives médicales belges. Liége.
33. Arch. méd.-chir. Appar. resp. Archives médico-chirurgicales de l'appareil respiratoire. Paris.
34. Arch. néerl. Physiol. Archives néerlandaises de physiologie de l'homme et des animaux. Amsterdam.
35. Arch. Otolaryng., Chicago. Archives of Otolaryngology. Chicago.
36. Arch. Path. Lab. Med. Archives of Pathology and Laboratory Medicine. Chicago.
37. Arch. Psychol., N. Y. Archives of Psychology. New York.
38. Arch. Sci. biol., Moscou.• Archives des sciences biologiques. Moscou. Arkhiv biologicheskikh nauk. Moskva.
39. Atti Soc. ital. Progr. Sci. Atti della Società italiana per il progresso delle scienze. Roma.
40. Aust. J. exp. Biol. med. Sci. Australian Journal of Experimental Biology and Medical Science. Adelaide.
41. Beitr. Anat. &c., Ohr. Beiträge zur Anatomie, Physiologie, Pathologie, und Therapie des Ohres, der Nase und des Halses. Berlin.
42. Beitr. Klin. Tuberk. Beiträge zur Klinik der Tuberkulose und spezifischen Tuberkuloseforschung. (Klinische Beiträge.) Berlin.
43. Ber. ges. Physiol. Bericht über die gesamte Physiologie und experimentelle Pharmakologie. Berlin.
44. Bibl. Laeger. Bibliothek for laeger. Kjøbenhavn.
45. Biochem. Bull. Biochemical Bulletin. Lancaster, Pa.
46. Biochem. Z. Biochemische Zeitschrift. Berlin.
47. Biol. Abstr. Biological Abstracts. Menasha, Wis.
48. Biol. Listy. Biologické Listy. Praha.
49. Biol. méd. Biologie médicale. Paris.
50. Bol. Asoc. méd. P. Rico. Boletín de la Asociación médica de Puerto Rico. San Juan.
51. Bol. Farm. milit. Boletín de farmacía militar. Madrid.
52. Bol. Inst. Clin. quir. B. Aires. Boletín del Instituto de clínica quirurgica. Buenos Aires.
53. Boll. Soc. ital. Biol. sper. Bollettino della Società italiana di biologia sperimentale. Milano
54. Boll. Soc. med.-chir. Pavia. Bollettino della Società medico-chirurgica. Pavia.
55. Boston med. surg. J. Boston Medical and Surgical Journal. Boston.
56. Brit. med. J. British Medical Journal. London.
57. Brux. méd. Bruxelles médical. Bruxelles.
58. Bull. Acad. Méd. Belg. Bulletin de l'Académie royale de médecine de Belgique. Bruxelles.
59. Bull. Acad. Méd. Paris. Bulletin de l'Académie de médecine. Paris.
60. Bull. int. Acad. Cracovie. Bulletin international de l'Académie des sciences de Cracovie (de l'Académie polonaise des sciences).
61. Bull. N. Y. med. Coll., Flower & Fifth Ave. Hosps.*

Bulletin New York Medical College, Flower and Fifth Avenue Hospitals. (continuation of New York Medical College and Flower Hospital Bulletin.)
62. Bur. Min., Inf. Circ.; Bur. Min., Rep. Invest.; Bur. Min., Tech. Paper } *Bureau of Mines, Circulars, Mineral Resources, Reports of Investigations and Technical Papers, Washington, D. C.
63. Byull. eksp. Biol. Med.* Byulleten eksperimentalnoy biologii i meditsiny. Moskva.
64. C. R. Acad. Sci., Paris. Compte rendu hebdomadaire des séances de l'Académie des sciences. Paris.
65. C. R. Soc. Biol., Paris. Compte rendu hebdomadaire des séances et mémoires de la Société de biologie. Paris.
66. Canad. med. Ass. J. Canadian Medical Association Journal. Montreal.
67. Cardiologia.* Cardiologia. Internationales Archiv für Kreislaufforschung. Basel.
68. Carnegie Inst. Wash. Pub.* Carnegie Institution of Washington Publication. Washington, D. C.
69. Chem. Abstr. Chemical Abstracts. New York; Easton, Pa.
70. Chem. Apparatur. Chemische Apparatur. Leipzig.
71. Chem. Engng & Min. Rev. Chemical Engineering and Mining Review. Melbourne.
72. Chem. & Industr.* Chemistry and Industry (pub. under same cover with Journal of the Society of Chemical Industry). London.
73. Chem. metall. Engng. Chemical and Metallurgical Engineering. New York.
74. Chem. News. Chemical News and Journal of Physical Science. London.
75. Chem. Warfare Bull. Chemical Warfare Bulletin. Edgewood, Md.
76. Chem. Weekbl. Chemisch Weekblad. Amsterdam.
77. Chem. Zbl. Chemisches Zentralblatt. Berlin.
78. Chemikerztg. Chemikerzeitung. Cöthen (Anhalt).
79. Chim. et Industr. Chimie et industrie. Paris.
80. Cincinn. J. Med.* Cincinnati Journal of Medicine. Cincinnati. (continuation of J. Med.)
81. Circ. Paint Mfrs' Ass. U. S. Circular Paint Manufacturers' Association of the United States. Scientific Section. Philadelphia.
82. Colliery Guard. Colliery Guardian. London.
83. Contrib. med. Res. (Vaughan) Ann Arbor, Mich.* Contributions to Medical Research, dedicated to Victor Clarence Vaughan by Colleagues and Former Students of the Department of Medicine and Surgery of the University of Michigan. June, 1903.
84. Draeger Bull. (Hft.). Draeger Bulletin (Hefte). Lübeck.
85. Dtsch. Arch. klin. Med. Deutsches Archiv für klinische Medizin. Berlin.
86. Dtsch. med. Wschr. Deutsche medizinische Wochenschrift. Leipzig.
87. Dtsch. Militärarzt.* Deutsche Militärarzt. Monatsschrift für die Sanitätsoffiziere des Heeres, des Kriegsmarine und der Luftwaffe. Berlin.
88. Edinb. med. surg. J.* Edinburgh Medical and Surgical Journal. Edinburgh.
89. Ergebn. Physiol. Ergebnisse der Physiologie. München.
90. Exp. Sta. Rec. Experiment Station Record. Office of Experiment Stations. Washington.
91. Eye, Ear, Nose Thr. Mon. Eye, Ear, Nose and Throat Monthly. Chicago.
92. Fabriksfeuerwehr. Fabriksfeuerwehr. Wien.
93. Fisiol. e Med. Fisiologia e medicina. Roma.
94. Fiziol. Zh. S.S.S.R.* Fiziologicheskiy zhurnal. S.S.S.R. Moskva. Journal of Physiology of the U.S.S.R. Moscow.
95. Flight Surg. Top.* Flight Surgeon Topics. Randolph Field, Texas.
96. Fortschr. Röntgenstr. Fortschritte auf dem Gebiete der Röntgenstrahlen. Leipzig.
97. G. Clin. med. Giornale di clinica medica. Parma.
98. G. Med. milit. Giornale di medicina militare. Roma.
99. Gas- u. Wasserfach. Gas- und Wasserfach. München.
100. Gasmaske. Gasmaske. Berlin.
101. Gasschutz u. Luftschutz.* Gasschutz und Luftschutz. Munich.
102. Gaz. Combat, Déf. pass., Feu Sécur.* Gas de combat, défense passive, feu et sécurité. Paris.
103. Gazz. med. ital. Gazzetta medica italiana. Torino.
104. Gesundheitsing. Gesundheitsingenieur. Berlin.
105. Gig., bezopass. i pat. Truda.* Gigiena, bezopasnost' i patologia truda. Moskva.
106. Guy's Hosp. Rep. Guy's Hospital Reports. London.
107. Handb. biol. ArbMeth.* Handbuch der biologischen Arbeitsmethoden. Edited by Emil Abderhalden. Berlin, Urban und Schwarzenberg.
108. Heart. Heart. London.
109. Helvet. med. Acta.* Helvetica medica Acta. Basel.
110. Hospitalstidende. Hospitalstidende. Kjobenhavn.
111. India Rubb. World. India Rubber World. New York.
112. Industr. Engng Chem. Industrial and Engineering Chemistry. Easton, Pa.
113. Int. Congr. Hyg. (Demogr.). International Congress on Hygiene (and Demography).
114. J. Amer. med. Ass. Journal of the American Medical Association. Chicago.
115. J. Amer. pharm. Ass. Journal of the American Pharmaceutical Association. Baltimore.
116. J. Aviat. Med. Journal of Aviation Medicine. St. P.
117. J. biol. Chem. Journal of Biological Chemistry. Baltimore.
118. J. clin. Invest. Journal of Clinical Investigation. Lancaster, Pa.
119. J. exp. Med. Journal of Experimental Medicine. New York.
120. J. exp. Psychol. Journal of Experimental Psychology. Evanston, Ill.
121. J. Hyg., Camb. Journal of Hygiene. Cambridge.
122. J. industr. Hyg. Journal of Industrial Hygiene and Toxicology. Baltimore.
123. J. Lab. clin. Med. Journal of Laboratory and Clinical Medicine. St. Louis.
124. J. Méd. Bordeaux. Journal de médecine de Bordeaux.
125. J. Méd. Paris. Journal de médecine de Paris.
126. J. orient. Med. Journal of Oriental Medicine. Mukden, Manchoukuo.
127. J. Physiol. Journal of Physiology. London; Cambridge.
128. J. Physiol. Path. gén. Journal de physiologie et de pathologie générale. Paris.
129. J. R. Army med. Cps. Journal of the Royal Army Medical Corps. London.
130. Jap. J. med. Sci. Japanese Journal of Medical Sciences. Transactions and Abstracts. Tokyo.
131. Kenya E. Afr. med. J. Kenya and East African Medical Journal. Nairobi.
132. Khim. Oborona.* Khimiâ i oborona. Moscow.
133. Klin. Med., Mosk. Klinicheskaya meditsina. Moskva.
134. Klin. Wschr. Klinische Wochenschrift. Berlin.
135. Kolloidchem. Beih. Kolloidchemische Beihefte. (Ergänzungshefte zur Kolloidzeitschrift.) Dresden.
136. Kolloidzschr. Kolloidzeitschrift. Dresden.
137. Lancet. Lancet. London.
138. Laryngoscope, St. Louis. Laryngoscope. St. Louis.
139. Lek. wojsk. Lekarz Wojskowy. Warszawa.
140. London chem. Soc. Abstr.* London Chemical Society Abstracts.
141. Luftfahrtmed.* Luftfahrtmedizin. Berlin.
142. Mech. Engng, N. Y. Mechanical Engineering. New York.
143. Med. Commun. Mass. med. Soc. Medical Communications. Massachusetts Medical Society. Boston.
144. Med. J. Rec. Medical Journal and Record. New York.
145. Med. Klinik. Medizinische Klinik. Berlin.
146. Med. Res. Coun. (Grt. Brit.), Spec. Rep. Ser.* Medical Research Council. Great Britain. Special Report Series. London.
147. Med. Welt. Medizinische Welt. Berlin.
148. Médecine. Médecine. Paris.
149. Medicina, B. Aires.* Medicina. Buenos Aires.
150. Mém. C. R. Trav. Soc. Ing. civils France.* Mémoires et comptes rendus des travaux de la société des Ingénieurs civils de France. Paris.
151. Metallbörse. Metallbörse. Berlin.
152. Milit. Surg. Military Surgeon. Washington.
153. Minerva med., Torino.* Minerva medica. Torino.
154. Montan. Rdsch. Montanistische Rundschau. Wien.
155. Mschr. Ohrenheilk. Monatsschrift für Ohrenheilkunde und LaryngoRhinologie. Wien.
156. Münch. med. Wschr. Münchener medizinische Wochenschrift. München.
157. Munic. Engng sanit. Rec. Municipal Engineering and the Sanitary Record. London.
158. N. Y. med. J. New York Medical Journal. New York.
159. Nat. Safety News. National Safety News. Chicago.
160. Nature, Paris. Nature. Paris.
161. Naturforscher. Naturforscher. Berlin.
162. Nav. med. Bull., Wash. Naval Medical Bulletin. Washington.
163. Nord. Med., Stockholm.* Nordisk medicin. Stockholm.
164. Northw. Lancet. Northwestern Lancet. Minneapolis.
165. Nutr. Abstr. Rev. Nutrition Abstracts and Reviews. Aberdeen.
166. Nutr. Lab. Abstr.* Abstract from files in Carnegie Institution of Washington, Nutrition Laboratory.
167. Occup. & Hlth. Occupation and Health (International Labour Office). Geneva.
168. Otolaryng. slav.* Otolaryngologia slavica. Prague.
169. Pam. Z. Zjazdu nauk. Of. Sluzby Zdrowia.
170. Paris méd. Paris médical. La semaine du clinicien. Paris.
171. Pflüg. Arch. ges. Physiol. Pflügers Archiv für die gesamte Physiologie des Menschen und der Tiere. Berlin.
172. Pharm. Weekbl. Pharmaceutisch Weekblad voor Nederland. Amsterdam.
173. Pharm. Ztg. Berl. Pharmazeutische Zeitung. Berlin.
174. Philos. Trans. Philosophical Transactions of the Royal Society. London.

175. Physiol. Abstr. Physiological Abstracts. London.
176. Physiol. russe. Physiologiste russe. Moscou.
177. Policlinico. Policlinico. Roma.
178. Polsk. Przegl. Med. Lotn.* Polski przeglad medycyny lotniczej. Warszawa. Revue polonaise de la médicine aéronautique. Varsovie.
179. Pr. méd. Presse médicale. Paris.
180. Preventive Eng. Ser. Bull.*
181. Proc. nat. Acad. Sci., Wash. Proceedings of the National Academy of Sciences. Washington.
182. Proc. roy. Soc. Proceedings of the Royal Society. London.
183. Proc. Soc. exp. Biol., N. Y. Proceedings of the Society for Experimental Biology and Medicine. New York. (Utica, N. Y.)
184. Progr. méd., Paris. Progrès médical. Paris.
185. Protar.*
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The Local Sections

—*American Industrial Hygiene Association*—

THERE are now nine active Local Sections of the American Industrial Hygiene Association located in the following areas: Chicago, Georgia, Michigan, New England, New Jersey, New York, Northeastern Ohio, Pittsburgh, St. Louis, and Washington-Baltimore.

Under the sponsorship of the Georgia Section, a group of American Industrial Hygiene Association members from surrounding states met in Atlanta last June to consider the formation of additional Local Sections in that area. The Local Sections Committee and the Board of Directors have recommended that two additional sections be formed, one to include the states of South Carolina, North Carolina, Southern Virginia, and Eastern Tennessee; the other to include Western Tennessee, Alabama, Mississippi, Arkansas, and Louisiana. These areas are larger than desirable for the most effective action in a local section, and it is hoped that in the future these two sections can be further divided into smaller local section areas.

There are several other areas which have expressed an interest in the formation of local sections of the AIHA. These include Eastern Pennsylvania, Western New York, Southwestern Ohio, Colorado, and California. It is hoped that members residing in these areas will give further consideration to activities which will lead to the establishment of these local sections in the near future. Members of the Local Sections Committee can be contacted to give assistance on these projects.

—E. C. BARNES, Chairman,
Local Sections Committee.

Mercury Vapor Hazards in Certain Chemical Laboratories

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THE health hazards of atmospheric mercury vapor in laboratories, due to a wide dispersion of mercury particles, have been studied and reported in the literature in previous years.[1,2,3] Many industrial technical personnel are not aware that the low vapor tension of mercury (0.002 millimeters of mercury at room temperatures) is sufficient to produce a mercury vapor concentration much in excess of the maximum allowable concentration (M. A. C.) of 0.1 milligram per cubic meter of air (mg/m^3). This value is equal to 0.012 parts of mercury vapor per million parts of air by volume (ppm) in an enclosed space.

During the last five years the Industrial Hygiene Division of the U. S. Public Health Service had occasion to investigate many chemical and physical testing laboratories in a variety of industrial plants for occupational health hazards. Certain of these laboratories used metallic mercury in extraction apparatus, nitrometers, flow meters, and manometers, and for amalgamation purposes in detecting cracks in alloy metals. Successive investigations in these laboratories revealed the presence of progressively higher mercury vapor concentrations in the room air, and the need for control measures to protect the workers' health.

General Observations in the Laboratories

IN MANY instances very little consideration had been given to the proper construction of laboratories, arrangement of facilities, and adequate ventilation relative to the use of mercury for testing purposes. Other factors such as inexperienced laboratory technicians and inadequate housekeeping methods also contributed to the mercury contamination of the laboratory spaces. Wood and/or porous concrete flooring trapped and retained the particles of mercury. After several years' usage, such flooring contributed heavily to the atmospheric mercury vapor concentrations and resisted cleaning efforts. In several instances, sinks, drainage troughs, and sections of flooring under the test instruments were covered with lead for resisting spilled acids. Amalgamation of the lead with mercury became a serious source of air contamination. Mercury cleaning apparatus was seldom equipped with trays to catch accidentally spilled mercury, and drying ovens were rarely exhaust ventilated to the outdoors. Generally, little foresight had been used to provide catch trays of sufficient area and depth underneath the chemical apparatus to prevent wide dissemination of accidentally spilled mercury. Housekeeping methods consisted of sweeping and occasional wet mopping which increased the area of exposed mercury by breaking up the mercury globules or removing the coating of oil or oxide film.

General ventilation for the laboratories was obtained mainly through open doors and windows in the summer and through infiltration in the winter. In several laboratories small exhaust ducts had been provided in the rear of the nitrometer apparatus to remove the small amounts of nitrogen oxides released by the nitrometers. However, the air removal rates were too low to provide any material assistance in reducing the mercury vapor concentrations of the rooms by dilution.

Method of Mercury Vapor Determination

THE atmospheric mercury vapor concentrations in the laboratories were measured with a General Electric portable mercury vapor detector. The detector is one of the optical type, and its operation depends on the opacity of mercury vapor to ultraviolet light of a certain wave length, 2537 A°.

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The chassis of the instrument encloses a fan which draws air through the chamber at one end and discharges through a port at the other end. A source of 110 volts, 60 cycle current, is required for the operation of the instrument. A line voltmeter and rheostat are supplied to permit proper adjustments before measurements are made.

The detector will measure directly mercury vapor concentrations ranging from 2.2 mg/m^3 (0.33 ppm) down to about 0.007 mg/m^3 (0.001 ppm). Concentrations up to 13 mg/m^3 can be measured by dilution of the contaminated air with known proportions of fresh air. The mercury vapor can be carried by any gaseous medium which does not have a spectral absorption band overlying the 2537 A° region. Ozone does have such an absorption and affects the detector in the same manner as mercury. Illuminating gas likewise affects the instrument. Of the *usual industrial solvents*, the only vapors to absorb 2537 A° line significantly are benzene, pyridine, diethylacetol, and toluene. Hydrogen, ammonia, and nitrogen do not affect the detector. Smoke, fog, and dust act as physical light barriers and must be kept from the instrument chamber.

Results of Investigations

THE data shown were selected from many surveys made in a group of laboratories which were constructed or began operating about 1941. Table 1 illustrates the increase in the magnitude of mercury vapor concentrations in a number of laboratories due to the lack of adequate control measures as found during two successive investigations.

The concentrations shown in the first portion of the table under the heading "First Investigation" were found during the first year of operation of the laboratories. Under the heading "Second Investigation" are shown the concentrations found during the second year of operation of the same laboratories. No relationship apparently exists between the concentration of mercury vapor in the general room air and that found in the vicinity of the operation. The magnitude of mercury vapor in the general room air was primarily due to severe floor contamination with mercury particles. Near the operation the atmospheric contamination was due to spilled mercury on the floors and the exposed mercury in the apparatus.

Inspection of the table will reveal that the degree of air contamination during the second year of operation was markedly higher, as a result of the accumulative effects of superficial housekeeping programs, inadequate general room ventilation, and inadequate measures to minimize the dissemination of accidentally spilled mercury. In laboratory C-2, the large increase in mercury vapor concentration found during the second survey was due to a severe increase in floor contamination as a result of poor housekeeping. In the case of laboratories B-3, D-1, and D-2, the concentration of mercury vapor determined during the first year of operation was too low to warrant making any specific recommendations other than maintaining adequate housekeeping.

Table 2 is based on observations made on a second visit. The table illustrates strikingly the wide distribution of mercury contamination that can occur unless good housekeeping is maintained. The activities of laboratory C-2 had been increased and

TABLE 1.
INCREASE IN MERCURY VAPOR CONCENTRATIONS DUE TO LACK OF ADEQUATE CONTROL MEASURES

Laboratory	Section	Mercury vapor concentrations, milligrams per cubic meter of air (mg/m^3) — First Investigation: Vicinity of operation	First Investigation: General room air	Second Investigation: Vicinity of operation	Second Investigation: General room air
A-1	Nitrometer	0.18	0.09	0.27	0.21
A-2	Nitrometer	0.20	0.13	0.23	0.27
A-3	Nitrometer	0.16	0.04	0.23	0.13
B-1	Nitrometer	0.39	0.25	0.57	0.38
B-3	Nitrometer	Insignificant	Insignificant	0.15	0.17
C-2	Nitrometer	0.15	0.07	0.90	0.65
D-1	Ether extraction	Insignificant	Insignificant	1.9	0.1
D-1	Nitrometer	Insignificant	Insignificant	0.48	0.1
D-2	Nitrometer	Insignificant	Insignificant	0.85	0.16

the housekeeping had deteriorated, resulting in severe contamination of the work space. Moreover, the mercury particles had been carried on the workers' shoes from the laboratory into the adjoining balance room, office space, and lunchroom. The resulting contamination of the adjoining rooms, shown in Table 2, was as great as the contamination in the general laboratory. Housekeeping measures in laboratories D-1 and D-2 likewise deteriorated following the first investigation, resulting in severe mercury contamination of adjoining offices, balance rooms, and hallways, as well as increased contamination of the laboratory space. The concentrations in the adjoining rooms were as high as the concentrations in the general laboratory.

Table 3 shows the inadequate reduction in mercury vapor concentrations attained by several laboratories after partial compliance with the numerous recommendations made to each facility. In laboratory C-2, management attempted to obtain a reduction in mercury vapor concentrations below the M. A. C. of 0.1 mg/m^3, by the treatment of floors and contaminated surfaces with calcium polysulfide and sulfur. None of the other recommended control measures such as mechanical general room ventilation and scrubbing of the floors with soap and water previous to chemical treatment of the floors was complied with. After two months, the weekly periodic treatment of the floors resulted in an approximate 50% decrease in mercury vapor concentrations as shown in Table 3, but these concentrations were still three to five times greater than the M. A. C.

The reduction in mercury vapor concentrations attained in laboratory E-1 after partial compliance with the recommendations was likewise inadequate. In this instance the contaminated surfaces were scrubbed with soap and water to remove most of the mercury, followed by periodic

TABLE 2.
DISSEMINATION OF MERCURY BEYOND THE LABORATORY SPACES

Laboratory	Section	Mercury vapor concentrations Milligrams per cubic meter of air (mg/m^3): Vicinity of operation	General room air
C-2	Nitrometer	0.90	0.65
C-2	Balance room	—	0.50
C-2	Office	—	0.30
C-2	Lunch room	—	0.15
D-1	Nitrometer	0.40	0.20
D-1	Balance room	—	0.20
D-2	Nitrometer	0.85	0.16
D-2	Offices	—	0.16
D-2	Hallway	—	0.16

TABLE 3.
MERCURY VAPOR CONCENTRATIONS IN LABORATORIES FOLLOWING PARTIAL COMPLIANCE WITH RECOMMENDATIONS

Laboratory	Section	Mercury vapor concentrations Milligrams per cubic meter of air (mg/m^3)				Degree of compliance
		Prior to recommendations		After partial compliance with recommendations		
		Vicinity of operation	General room air	Vicinity of operation	General room air	
C-2	Nitrometers	0.90	0.65	0.50	0.37	Periodic treatment with calcium polysulfide and sulfur for two months. No ventilation. No floor washing.
E-1	Nitrometers	0.65	0.41	0.27	0.23	Scrubbing floors with soap and water. Periodic treatment of floors with calcium polysulfide and sulfur. Inadequate ventilation. Amalgamated sink not removed. Amalgamated floor not removed.
G-1	Nitrometers	0.65	0.22	0.80	0.40	General room ventilation; 15 air changes per hour. Nothing done to floors.

treatment with calcium polysulfide and sulfur. The other recommendations such as installing mechanical general room ventilation and removal of an amalgamated lead sink and sections of flooring were not followed. Consequently, satisfactory reduction in mercury vapor concentrations was not obtained, and the resulting air contamination was still about two to three times the M. A. C.

In laboratory G-1, management attempted to reduce the mercury vapor concentrations by installing mechanical general room ventilation without inaugurating an adequate housekeeping program and without scrubbing the floors with soap and water. Although 15 air changes per hour had been provided for the laboratory, Table 3 shows that the mercury vapor concentrations increased to a higher level than before the ventilation was installed. The increase in mercury vapor concentrations was due to increased floor contamination and superficial housekeeping. Mechanical general room ventilation, alone, was not adequate as a control measure.

That satisfactory reduction in mercury vapor concentrations in severely contaminated spaces can be attained, is shown in Table 4. In laboratory D-1, the mercury vapor concentrations were from two to four times the M. A. C. prior to compliance with recommendations. The mercury vapor concentrations were reduced well below the M. A. C. after the following recommendations had been completely fulfilled: (1) floors scrubbed with large amounts of soap and little water, followed by thorough rinsing; (2) varnishing of the wooden floors to seal the cracks and crevices; (3) waxing of the cleaned and varnished surfaces to provide an impervious and easily cleaned coating; and (4) installing a mechanical exhaust fan just above the floor level near the apparatus using mercury. In laboratory D-2, the mercury vapor concentrations were

TABLE 4.
MERCURY VAPOR CONCENTRATIONS IN LABORATORIES FOLLOWING COMPLETE COMPLIANCE WITH RECOMMENDATIONS

Laboratory	Section	Mercury vapor concentrations Milligrams per cubic meter of air (mg/m³): Prior to recommendations — Vicinity of operation	Prior to recommendations — General room air	After full compliance — Vicinity of operation	After full compliance — General room air	Recommendations fulfilled
D-1	Nitrometers	0.40	0.20	0.08	0.04	Floors scrubbed with soap and water. Varnish and wax applied to floor after cleaning. Mechanical general room ventilation installed. Fan placed just above floor level.
D-1	Balance room	——	0.20	——	0.04	Floors scrubbed with soap and water. Varnish and wax applied to floor after cleaning.
D-2	Nitrometers	0.85	0.16	0.10	0.04	Floors scrubbed with soap and water. Varnish and wax applied to floor after cleaning. Mechanical general room ventilations installed. Fan placed just above floor level.
D-2	Office	——	0.16	——	0.04	Floors scrubbed with soap and water. Varnish and wax applied to floor after cleaning.
D-2	Hallway	——	0.16	——	0.04	Floors scrubbed with soap and water. Varnish and wax applied to floor after cleaning.

likewise successfully reduced to less than the M. A. C. by the procedure previously outlined.

Conclusions

THE essential factors in preventing mercury vapor health hazards in chemical laboratories appear to be:

1. All the spilled mercury should be removed immediately.
2. Nonamalgamating impervious trays of sufficient area and depth should be used underneath apparatus employing mercury to minimize dispersion due to accidental spills. The bottoms of the trays should slope to one corner where a trap is located. This trap should be partially filled with water.
3. Smooth, hard finish flooring and bench tops impervious to mercury should be provided. Unfinished concrete or untreated wood surfaces are inadequate.
4. Walls should be glossy with a minimum of ledges to prevent mercury accumulations by settling or condensation.
5. Mechanical general room ventilation maintaining a minimum of 15 air changes per hour should be provided with the exhaust fan placed preferably just above the floor level. All mercury cleaning and drying operations should be conducted under a mechanically exhaust ventilated hood.

If mercury contamination of floors, benches, and walls has already occurred in a laboratory, immediate reduction of mercury vapor concentrations can be obtained while structural changes in the laboratory are being planned. Scrubbing contaminated surfaces with adequate amounts of soap and water, followed by rinsing with copious amounts of water, has been shown to be essential in reducing the mercury contamination. After the floors have dried, varnishing such surfaces followed by applications of hard wax ahs been found to produce impervious surfaces which facilitate cleaning. Mechanical exhaust ventilation, preferably applied just above the floor level, is necessary in reducing the mercury vapor concentrations.

Summary

INVESTIGATION of many chemical laboratories, which employed metallic mercury in chemical apparatus used for analytical work, revealed mercury vapor concentrations in excess of the maximum allowable concentration of 0.1 milligram per cubic meter of air. Accidental spills and poor housekeeping resulted in widespread and general contamination of floors and work benches. Treatment of contaminated surfaces with polysulfides was not found to be an adequate control measure. Thorough washing of the contaminated surfaces followed by waxing was most effective in reducing the exposure. Prevention of mercury dispersion was found to be essential and could be accomplished by means of trays placed underneath the apparatus to catch accidental mercury spills. Tables are presented showing the increase in mercury contamination revealed by consecutive investigations when appropriate control measures were not taken. The effective results obtained by various control measures are shown in tabulated form.

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William P. Yant

—Recipient of Pittsburgh Award—

WILLIAM P. YANT, D.SC., first President of the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION and Director of Research and Development, Mine Safety Appliances, Pittsburgh, Pennsylvania, was the recipient of the Pittsburgh Award for 1946 of that Section of the American Chemical Society. To quote *Chemical and Engineering News* which carried a complete account of the meeting held on December 19, on receiving the Award, DR. YANT said: "The old primitive concept of accepting damage to health, life, and property as an inherent part of industrial operations with effort directed to salvage and repair, has given way to the philosophy and to the art and science of prevention. Industrial Hygiene [includes] the normal interest of a wide variety of professions: chemistry in all its divisions, physics, engineering, medicine—physiology, pathology, psychiatry. There is much over-lapping of interest and knowledge; in fact, a professional hybrid is more essential than a pure-blood professional — a doctor of medicine-chemist-engineer cross or a chemist-engineer-toxicologist."

Powder Metallurgy and Industrial Hygiene

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WE HAVE been asked to say a few words in regard to powder metallurgy and the methods used in the preparation of metal powders. No doubt your particular interest in this subject rests in the long range effect of metal dusts and fumes on health rather than in any mechanical or physical attributes of a particular powder such as the ability of certain fine powders to become ignited, to burn, or to explode. Both the long range and short term effects of metal powders are potent factors and must be considered in the industrial hygiene study of metal powder production.

Let us start first with the classic definition of powder metallurgy. Powder Metallurgy is the art of producing metal powders and shaped objects from individual, mixed or alloyed metal powders, with or without the inclusion of non-metallic constituents, by pressing or forming objects which are simultaneously or subsequently heated to produce a coalesced, sintered, alloyed, brazed, or welded mass, characterized by the absence of fusion, or the fusion of a minor component only. In simpler language, powder metallurgy is the preparation of metal powders and the production of parts from these powders by a combination of pressure and heat, with the heat applied simultaneously or subsequent to the application of pressure so as to produce a substantially solid structure.

Powder metallurgy can be divided into two general classifications:

(a) Preparation of metal powders.
(b) Utilization of these metal powders.

OUR remarks will be concerned primarily with the first division—the preparation of metal powders—although it must be recognized that the second classification—the utilization of these metal powders—occupies fully as important a position in the industrial field and has its own problems of industrial hygiene. Certain of these problems are similar to those encountered in metal powder production; others are peculiar to the utilization of the powders.

The common methods used for preparing metal powders fall into twelve recognized classifications. For the purpose of this paper, each method is listed, described briefly, and typical examples are cited.

1. *Machining:* A solid rod of metal can be filed or milled automatically to produce small chips of metal powder. This process normally is expensive since the production rate is usually low. Dental alloys and solder powders are made by this process and, during the war, a considerable portion of the magnesium powder for military purposes was prepared in this manner.

2. *Milling:* Brittle or friable metals, alloys, compounds, or metallic oxides can be pulverized by grinding in cylindrically shaped mills partly filled with hard steel balls. This method produces a characteristically sharp, angular particle when a brittle metal is used as feed material, and a flaky particle when the feed material is less brittle. Other types of attrition mills include disc pulverizers in which material is ground between two discs rotating in opposite directions; rolls, in which a pair of revolving steel cylinders perform the function of crushing metal particles and hammer mills in which hammers rotating at high speed break up the metal by impact.

3. *Shotting:* Molten metals such as copper, zinc, aluminum, tin, nickel, lead, silver and gold when poured in a stream from the top of a high tower will, as the stream solidifies, be broken up into small pellets and globules of powder due to the high surface tension of the metal. Powders most commonly produced by this means are

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lead shot, shotted iron for blasting grit, and shot for rapid alloying in fusion metallurgy.

4. *Graining:* Certain metals (aluminum, brass) as they cool from the molten state, can be rapidly stirred and will form a relatively coarse powder as solidification takes place. This method, called graining, is not widely used in the preparation of metal powders since the graining results through the introduction of oxide as a film on the surface of the powder particles. These films cause a subsequent lack of welding or bonding when the finished metal powder is employed in powder metal compacts.

5. *Atomization:* Molten metal may be atomized by a stream of high pressure gas to form tiny spherical, teardrop, or dumbbell-like particles of powder. Air, steam, water, or even inert gas may be used as the atomizing medium. Two general methods of atomizing are used, (1) cross-jetting of the metal stream, and (2) inspirating of the molten metal through a specially designed nozzle by superheated, compressed air. Cross-jetting prodnces a much larger particle size metal powder than that which is made by inspirating through a nozzle, however, this cross-jet method can be used for all metals that can be melted. On the other hand, the finer powders that can be prepared by the use of a nozzle through which superheated, compressed air is passed, are presently limited to metals with a maximum melting point of 700°C (1292°F). By this method, molten metal is inspirated by superheated, compressed air as the air expand upon release through a specially designed nozzle. The atomized metal forms a spray of fine particles which is solidified and chilled due to the expansion of the air stream. These are carried through a collecting chamber into cyclone separators and dust collectors by means of suction supplied by power-driven fans. Aluminum, lead, tin, zinc, cadmium, and solder powders are made by this method.

6. *Condensation of Metal Vapors:* The classic example of this method of preparation is zinc. Zinc oxide heated in contact with a carbonaceous mixture, will react with the carbon monoxide present to form zinc vapor. Upon cooling, the zinc will precipitate as a fine, high-purity powder, whose major impurities are a trace of oxide plus some calcium oxide from the lime used as a source of carbon monoxide. This method of preparing powder is extremely cheap since the zinc powder is made in one of the steps for metallic zinc recovery. Zinc powder prepared by condensation has largely superceded zinc powder produced by atomization.

7. *Carbonyl Process:* The carbonyl process for preparing metal powders is limited commercially to nickel and iron. When carbon monoxide (CO) is passed over spongy masses of the metal at relatively low temperatures 220°C (428°F), liquid carbonyls of the metals are formed. These liquid carbonyls, which can be stored under pressures of approximately five atmospheres, will volatilize upon release. When pressure is released, and the carbonyl is cooled, the carbonyl gas decomposes and iron or nickel is precipitated as very fine powder. Larger pellets of controlled particle size may be produced by recirculating the fine powder.

8. *Reduction of Oxides of Metal:* The finely pulverized oxide of certain metals can, under certain controlled conditions of atmosphere and temperature, be reduced by the action either of a reducing gas or a solid reducing agent, to form a spongy, friable mass of metal which subsequently can be ground to a fine metal powder. The reduction is usually done in a gas-fired muffle type furnace for reduction temperatures up to 600°C (1112°F) or for higher temperatures in an electric resistance, enclosed-atmosphere furnace, capable of reaching 1100°C (2010°F). The reduction is carried out either by gases such as carbon monoxide, hydrogen, dissociated ammonia, or a prepared reducing gas combining these gases, or by a solid carbonaceous reducing agent (graphite, carbon, coke, etc.). The powdered oxide is conducted by means of a steel belt, rolls, or similar conveying mechanism, through the furnace. Under controlled temperature conditions, the oxygen in the metallic oxide combines with the hydrogen or carbon monoxide of the reducing gas or the carbon of a solid reducing material to form water vapor or carbon dioxide and leaves the metal in the reduced state. The sintered metal formed is cooled and removed from the furnace as a friable mass which can be pulverized to a fine, porous, spongy powder. Typical of the

metal powders prepared in this manner are copper, iron, nickel, and the refractory meals such as tungsten, tantalum, and titanium.

9. *Electrolytic Deposition:* When an electric current is passed through metal in solution under given conditions of solution concentration, current density, temperature, etc., the metal powder depends upon the selection of conditions of solution concentration and current density. This method is employed to prepare copper, iron, silver and other metal powders. The current density used to deposit powders is usually much higher than that required to deposit solid metal, and the solution concentrations are normally much greater. In certain cases a material such as glue, sugar, etc., is employed to keep current efficiency high and prevent the release of excess hydrogen at the cathode. A dendritic, fern-like or snowflake particle is produced by this method.

10. *Chemical Precipitation:* The fact that a metal lower in the electromotive series will cause another metal to be precipitated from solution while the first metal itself will be dissolved is well known. This property has been employed to prepared copper powder by precipitating the copper from a copper sulfate solution by iron scrap. Silver is precipitated by copper or zinc, tin is precipitated from stannous chloride solutions by zinc and similar cases may be cited. The nature of the particle produced by this method is similar to that made by electrodeposition; however, since the conditions can not be controlled so well, the range of particle size and shape of the metal powder is usually not so well defined and impurities from the precipitating metal and the solution may be carried along with the powder.

11. *Sintering (for preparing alloy powders):* Primary powders, made by one or more of the previously described processes, may be mixed in correct chemical proportion to form an alloy mixture and sintered by heating in a reducing or neutral atmosphere at a temperature below the melting point of the alloy to be formed. A sintered mass is produced which, since it has not been melted, can be pulverized. The degree of diffusion of the metals will depend upon the metals themselves, and the temperature and time of sintering employed.

12. *Liquid Disintegration:* A new method for preparing metal powders is that of liquid disintegration. Here a high-speed, revolving jet of liquid strikes a falling stream of molten metal, breaking the molten metal into small droplets which are chilled by the stream of liquid and form small particles of metal powder. These particles may be spherical or irregular in shape, and may be either solid or hollow depending on the metal, its melting point and the force of the jet among other factors. By means of this method of powder preparation it is possible to prepare not only primary powders (those of one metal) but alloy powders as well, since the only requirement is that the metal be molten and capable of being poured in a stream.

There are, of course, other methods by which metal powders can be prepared but the twelve methods cited herein cover substantially all of the powder made in normal production that would be encountered in the normal studies of industrial hygiene.

The Role of Industrial Hygiene in Powder Metallurgy

THE powder metallurgy field is both relatively new and of somewhat limited scope when contrasted to many other industries. Its problems are of considerable importance and will merit considerable attention from the standpoint of industrial hygiene.

In regard to the contacts we have had with the industrial hygiene problems of metal powder production, it should be noted that the examples to be cited must be regarded as limited in scope in many instances and applicable largely to the particular case under discussion. It was found that over-exposure to copper dust and particularly copper oxide dust, caused severe itching and simulated "chills." It was also found that repeated baths could not remove all of the "green" copper stain eminating from the skin of one working in this dust. It was also noted that immunity to these factors could not be built up simply by continued exposure.

Cadmium dust in very minute concentrations causes a nauseous feeling in the stomach, and since this feeling is so readily observed, it is somewhat of a criterion of over-exposure.

Zinc dust gives the well known zinc "chills" when one comes in to close contact with this material. Since the average person is quite sensitive to small amounts of zinc dust in the atmosphere, physical reactions are readily observed.

It is of interest to note that contrary to what is the normal experience and would be the normal expectation, a complete medical examination of men producing lead dust strangely enough did not disclose any cases of "lead poisoning," despite the fact that a number of them had been working in relatively close contact with the powder for a considerable period of time. One point that should be noted here is the fact that approved respirators were worn at all times; secondly, the powder, while 90% and more would pass a sieve with 325 meshes per linear inch (.044 millimeter opening) had less than 20% of its particles under 5 microns (.005 millimeter) in size and therefore could not be compared as being of the same degree of fineness as a pigment powder. Additionally, we were dealing with powder which normally has a very fine film of oxide formed on the surface immediately after preparation.

In pointing out these facts, we must repeat that we have made references which are limited to the range of our study of plant conditions, and that any remarks must be considered in that light. No reference has been made to the hazards of explosion usually caused by electrostatic charges set up in the dust collecting systems. It appears that these explosions usually result from a "buildup" over a long period of time and that these time periods are rather uniform. The current practice is to tear down the entire dust collecting unit at regular intervals and rebuild it. These intervals are so spaced as to include a safety factor in relation to the expected explosibility period.

In closing we would like to say that since the preparation of metal powders presents so many unique and different industrial hygiene problems in the individual metal powder plants, each plant requires a separate and special study of its own problems.

Nominees for AIHA Offices, 1947-1948

BALLOTS will be sent shortly to members of the Association for election of officers to take office following the Annual Business Meeting in Buffalo on May 1, 1947. Although the nominees are well known to the greater number of Association members, a brief biographical sketch is here presented to assist in identifying them to all the membership.

Nominees for President-Elect:

JAMES H. STERNER: B.S. in Chemistry, Pennsylvania State College, 1928; M.D., Harvard Medical School, 1932; since 1936, Dir., Laboratory of Industrial Medicine, Eastman Kodak Company; 1941-45, Consultant, Holston Ordnance Works (RDX manufacturer); 1943-45, Med. Dir., Clinton Engineer Works, Tennessee Eastman Corporation; 1946 to date, Member, Medical Advisory Board, Atomic Energy Commission; 1942-45, Member, Board of Directors, American Industrial Hygiene Foundation. Fellow, Amer. Med. Assn.; Amer. Public Health Assn.; Amer. Assn. of Ind. Phys. and Surgeons; Amer. Academy of Occ. Medicine. Member, Amer. Ind. Hygiene Assn.; Amer. Chem. Society; Amer. Statistical Assn. Publications in fields of toxic responses to organic chemicals, selenium content of urine, maximum allowable concentrations, and use of radioactive phosphorus in the study of skin absorption of a plasticizer.

REUEL C. STRATTON: B.S. in Chemistry, Trinity College, Hartford, Conn., 1916; Chemist, Scovill Mfg. Co., Waterbury, Conn., 1916; Asst. Chief Chemist. New Departure Mfg. Co., Bristol, Conn., 1917; Supv. Chem. Eng., Travelers Insurance Companies, Hartford, Conn., 1919 to date; Special Asst. to the Director of Safety, Office of the Chief of Ordnance (Lieut. Colonel, Ordnance Dept.) 1942-45. Member, Constitutional Committee, 1940, and of Board of Directors, 1941-43, American Industrial Hygiene Association; Chairman, Executive Board, National Safety Council. Member, Committee on Toxic Dusts and Gases, American Standards Association, 1937-date; Active member Amer. Inst. of Chem. Engineers; Member, Amer. Ind. Hygiene Assn.; Amer. Chem. Soc.; Amer. Soc. of Safety Eng.; Amer. Soc. for Testing Materials; Conn. Safety Soc.; Chemists Club (N.Y.C.); Regist. Prof. Eng. in Conn., Penn. and New Jersey; Life member, New Jersey State Soc. of Prof. Eng. Publications in the fields of determination and control of atmospheric contaminants.

Nominees for Board of Directors:

ANNA M. BAETJER: B.A., Wellesley College; Sc.D., Johns Hopkins Univ. School of Hygiene and Public Health; Assistant Professor, Department of Physiological Hygiene, Johns Hopkins Univ. and in chge. of industrial health

work at the School of Hyg. and Publ. Health; Member, Advisory Comm. on Sanitation, Baltimore City Health Dept., Consultant to the Office of the Surgeon General, Army Industrial Hygiene Laboratory; Member, Comm. of Education and Terminology of the American Industrial Hygiene Association. Member, Amer. Ind. Hygiene Assn.; American Publ. Health Assn.; Amer. Physiological Soc.; Amer. Conf. of Governmental Ind. Hygienists. Author of "Women in Industry: Their Health and Efficiency," recently published under the auspices of the National Research Council, and of sections on temperature, humidity and abnormal atmospheric pressures in several books. Publications on research work in the fields of applied physiology and industrial health.

A. GIRARD CRANCH: B.A., Univ. of Pennsylvania, 1903; M.D., N.Y. Homeopathic Med. College, 1906; Surgeon, Hammermill Paper Mills, Erie, Pa., 1909-11; Plant Physician, General Electric Company, Erie, Pa., 1916-19; Med. Dir., National Carbon Co., Inc., Cleveland, Ohio, 1919-37; Head, Industrial Toxicological Dept., Union Carbide and Carbon Corp., New York, 1937 to date. Member, Committee on Toxic Dusts and Gases, Amer. Standards Assn.; Med. Advisory Comm. to the Comm. on Healthful Working Conditions, Nat. Assn. of Mfgrers; Standing committees of Mfg. Chemists' Assn. and Amer. Welding Soc. Fellow, Amer. Med. Assn.; Amer. Publ. Health Assn.; Amer. Assn. of Ind. Phys. & Surgeons; Member, Amer. Ind. Hyg. Assn.; New York State Med. Soc.; Amer. Acad. of Occ. Med. Assoc. Member, Amer. Soc. of Safety Eng.; Acad. of Med. of Cleveland; Intern. Acetylene Assn. Over last 30 years, full time in industrial medicine with special attention to occupational disease problems. Member of numerous committees or in advisory capacity in many organizations dealing with public and industrial hygiene problems. Published and lectured on these subjects in university courses in Ohio and New York.

N. V. HENDRICKS: B.E. and Ch.E. in Chem. Eng., Vanderbilt Univ.; ind. hygiene training at Graduate School of Engineering, Harvard Univ.; research in biochemistry, Vanderbilt Univ. School of Medicine, production and processing of milk products, the Borden Company; engineering activities in the fields of water supply, sewage treatment, stream pollution, and industrial waste treatment, Tennessee Dept. of Health; Asst. Dir., Div. of Industrial Hygiene, Georgia Dept. of Public Health, 1941-47. President and Past Secretary, Atlanta Chapter, Georgia Soc. of Prof. Engineers; National Representative of the Nat. Soc. of Prof. Engineers; Sec.-Treas. and Past Pres., Georgia Section, Amer. Ind. Hyg. Assn.; Chm., Membership Comm. Amer. Ind. Hyg. Assn. Member, Comm. on Prof. Standards, Amer. Conf. of Gov. Ind. Hygienists. Consultant on Publ. Health Engineering to the Georgia Board of Registration for Engineers.

HAROLD CARPENTER HODGE: B.S. Illinois Wesleyan Univ., 1925; M.S. State Univ. of Iowa, 1927; Ph.D., State Univ. of Iowa, 1930; Grad. Asst. State Univ. of Iowa, 1925-29; Asst. Prof. of Chem., College of the Pacific, Stockton, Calif., 1929-30; Professor of Chem., Ottawa Univ., Ottawa, Kan., 1930-31; Rockefeller Fellow in Dentistry, 1931-33, Rockefeller Senior Fellow in Dentistry, 1933-36, Asst. Prof. of Dentistry (Biochemistry), 1936-37; Assistant Professor, 1937-40, Assoc. Prof., 1940-46, and Professor of Pharmacology and Toxicology, 1946-date, the Univ. of Rochester School of Med. and Dentistry. Special Consultant, U. S. Public Health Service, 1946; Chem. Tech. Adv. Comm. on the Fluorination of Water Supplies, State of New York Dept. of Health, 1944-date; Chief Pharmacologist, Manhattan Dept., Univ. of Rochester Atom Bomb Project. Member, Amer. Ind. Hyg. Assn.; Amer. Chem. Soc., and other associations. Publications in foregoing fields.

L. V. TAYLOR: B.S., 1927, B.A., 1928, M.A., 1930, Univ. of Missouri; Instructor, Agriculture Chem. Dept., Univ. of Missouri, 1928-30; Chief Chemist, State Bd. of Agriculture, Jefferson City, Mo., 1930-33; Supervisor Food Inspection and Analysis, 1933-41 and Supervisor of Industrial Hygiene, 1941-date, American Can Company. Member, Exec. Comm., 1943-46 and Vice-Chm., 1946-47, Chicago Section, American Ind. Hyg. Assn.; Dir. Chicago Section, Amer. Chem. Society; Councilor, Chicago Section, Institute of Food Technologists. Member, Amer. Ind. Hyg. Assn.; Amer. Chem. Soc.; Inst. of Food Technologists. Publications in the fields of metals and organic materials in foods, and industrial hygiene organization in a large multiple plant concern.

Industrial Hygiene Lectures

—At New York State College of Ceramics—

A SERIES of five lectures on industrial hygiene is being given at the New York State College of Ceramics by MR. K. L. DUNN, Industrial Hygienist of the Corning Glass Works. The first of these lectures was presented Friday at 4:30 P.M., November 15, with subsequent lectures on succeeding Fridays. Attendance is required of all senior, ceramic engineers and glass technologists. Inclusion of such a course in engineering and chemical curricula should be more widely adopted.

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Leroy Upson Gardner

THE death of LEROY UPSON GARDNER on October 24, 1946, shocked and saddened his friends and associates in many walks of life in this and in other countries, but it was nothing short of tragedy to his colleagues in the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION. In this group in which he was so well known and so much beloved, his simplicity, his modesty, his unfailing kindliness, his extensive knowledge, his rich experience, and his broad wisdom gave him a stature which few can hope to attain, and an influence which will be achieved but rarely in the days that are to come. Those who have worked with him will never forget his patience and his wise council, and those whom he has taught, who number all that have but listened and observed, will always feel the heavy debt they owe him.

But this, you may say, is not tragic, for to remember one's gratitude and affection for a good friend is pleasant pain, and to recognize the timeless qualities of greatness is to be reassured in faith and strength. The tragedy springs from the feeling that this man's work, while huge and invaluable, was incomplete, and from the belief that much that he knew in his special field is not known to others, and has died, for the time, with him. Such knowledge, the ripened fruit of a mind well balanced by work and experience, the world can ill afford to lose. Let us hope, therefore, that the data and the observations of DR. GARDNER'S work of recent years, richly interlarded with his notes and critical comments, may be available for careful compilation and publication. This great and good man's monument can only be the record of his work. No more fitting labor of love and respect could be achieved than that of building it to its full height.

—ROBERT A. KEHOE,
Past-President, AIHA.

American Industrial Hygiene Association

—News of Local Sections—

Chicago Section

"THE ROLE of Color Planning in the Industrial Workroom in Relation to Health, Safety and Production" was presented by COLONEL GEORGE D. GAW, Director, Color Research Institute of America, on October 16, 1946.

"Industrial Hygiene Exposures" was the subject of the meeting held November 20, 1946. DR. E. L. BELKNAP, Milwaukee, Wisconsin, spoke from the title "Clinical Aspects, Acute Mercurial Intoxication Due to Occupational Mercury Exposures." MR. PAUL LANGE, Employers Mutual Insurance Company, Milwaukee, discussed "The Engineering Control of Industrial Mercury Hazards" with reference to the source of exposure and methods of control at the plant where the cases developed by DR. BELKNAP occurred. These papers were discussed by DR. WILLIAM D. MCNALLY.

The December 18 meeting was addressed by LEON JACOBSON, M.D., Assistant Dean of the Medical School, Chicago University, on the subject, "Medical Aspects of Nuclear Energy." JOHN D. ROSE, PH.D., Director of Hazards Evaluation, Argonne National Laboratories, Chicago, discussed "The Protection of Personnel Using Radioactive Elements."

Georgia Section

AT THE meeting held on December 19, at the Georgia School of Technology, DR. LOUIS SCHWARTZ, of the U. S. Public Health Service, discussed "Treatment and Prevention of Occupational Skin Diseases." His talk was illustrated with various slides based on his personal experiences.

MR. HOSMER, Research Economist, Engineering Experiment Station, Georgia School of Technology, discussed a proposed pamphlet to be prepared jointly by the Engineering Experiment Station of Georgia School of Technology and the Division of Industrial Hygiene, Georgia Department of Public Health. This will present information on the industries in the state, and the health hazards associated with them.

Michigan Section

"FOREMEN'S Problems in Health Safety and Industrial Hygiene" was the subject of a

panel discussion held by the Michigan Industrial Society on December 5, 1946, in Detroit. MR. A. O. THALACKER, Vice-President and General Manager, Detrex Corporation, served as moderator and the participants were A. L. BROOKS, M.D., Medical Director, Fisher Body Division, General Motors Corporation; EDWARD E. DART, M.D., Director, Industrial Hygiene Division, Chrysler Corporation; MISS ISABELLE PHALIN, President, Detroit Industrial Nurses Association; and MR. WILLIAM SMITH, Safety Director, Ford Motor Company.

MR. J. BRENNAN GISCLARD, Chief Chemist of the Bureau of Industrial Hygiene, Detroit Department of Health is acting Secretary-Treasurer following MR. FUNKE'S resignation.

New England Section

A FULL day's meeting was held on Saturday, November 23, at the auditorium of the Liberty Mutual Insurance Company with 60 members and guests attending. The following program was presented:

"Carbon Tetrachloride Intoxication: Report of an Unusual Case"—DR. MARSHALL CLINTON, JR., Department of Industrial Hygiene, Harvard School of Public Health.

"The Possibility of Chronic Cadmium Poisoning"—DR. HARRIET L. HARDY and MR. JOHN B. SKINNER, Division of Occupational Hygiene, Massachusetts Department of Labor.

"The Determination of Lead and Zinc Simultaneously in Atmospheric Samples"—MR. A. S. LANDRY, Division of Industrial Hygiene, Massachusetts Department of Labor.

"Factors Affecting Foot Comfort"—DR. A. B. ANDERSON, Laboratory of Industrial Physiology, Graduate School of Business Administration, Harvard University.

"The Toxicity of 2-nitropropane"—MR. JOHN B. FAHY, Division of Occupational Hygiene, Massachusetts Department of Labor.

"Air Sampling in Cotton Textile Mills"—MR. FREDERICK J. VILES, JR. and DR. LESLIE SILVERMAN, Department of Industrial Hygiene, Harvard School of Public Health.

"Absorbtion of Vapors in Liquids"—DR. HERVEY B. ELKINS, Division of Occupational Hygiene, Massachusetts Department of Labor.

"A Study of Methyl Bromide Exposures in Fumigation"—ALBERT F. BUSH, California State Department of Health, Berkeley, California.

New Jersey Section

THE first Christmas party of the New Jersey Section was held in East Orange on December 19. Reports from the 35 members who attended indicate that this will become an annual affair.

Metropolitan New York Section

THE October 24, 1946, meeting was held in the afternoon at the American Museum of Natural History. MR. WILLIAM B. HARRIS, Industrial Hygiene Engineer, New York State Department of Labor, discussed a direct-reading anemometer.

MR. F. G. FIRTH, Industrial Division, North American Phillips Company, Inc., New York, discussed "The Use of X-ray Diffraction for Chemical Analysis."

DR. IRVING R. TABERSHAW, Industrial Medicine Consultant, Liberty Mutual Insurance Company, New York, spoke on "Health Hazards in the Use of Beryllium."

MR. E. H. R. PEGG, Aerotec Company, White Plains, discussed "The Use of Electrostatic Precipitation for Industrial Dust Collection."

The meeting was concluded by a paper on "Estimation of Sulphur Compounds in Air" by SAMUEL MOSKOWITZ, PH.D., Senior Chemist and BENJAMIN FEINER, Industrial Hygiene Engineer, New York State Department of Labor.

On December 5, 1946, MR. JOHN SHAW, Assistant Director of the Metal Powder Laboratory, Stevens Institute of Technology, Hoboken, New Jersey, gave an illustrated discussion and review of powder metallurgy.

Northeastern Ohio Section

INDUSTRIAL Hygiene and Safety in Germany" was the subject discussed by E. G. MEITER, PH.D., Director of the Industrial Hygiene Division of the Employers Mutual Liability Insurance Company, Milwaukee, at the September 27 meeting which was attended by some 33 members and guests.

C. O. SAPPINGTON, M.D., D.P.H., Chicago, was the speaker at a meeting held in Cleveland, Ohio, on December 10, 1946. DR. SAPPINGTON gave a most interesting talk on modern trends and thoughts in industrial hygiene.

Pittsburgh Section

THE September 24 meeting of the Pittsburgh Section was held at the United States Bureau of Mines Experiment Station. MR. A. M. STANG, District Industrial Hygiene Engineer, Pennsylvania Bureau of Industrial Hygiene, outlined briefly the history of the Bureau. MR. STANG also discussed a study being conducted at the present time on health hazards in dry cleaning plants.

Washington-Baltimore Section

AT THE October 15 meeting in the Officers Club. Naval Gun Factory, Washington, D. C., with 24 members and guests attending, COMMANDER E. E. METCALF, of the Naval Medical Research Institute, Bethesda, Maryland, speaking on "Recent Advances in Atmospheric Hygiene," included the effects of high effective temperatures on the human body, the control of odors in inhabited spaces, heat rash from hot environment, and a new type salt tablet.

DR. RONALD E. LANE, Professor of Industrial Health, Manchester University, England, spoke before the section on November 22, 1946, on the subject "Present and Future Industrial Hygiene Programs in England."